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Operating Experience Summary

Office of Nuclear and Facility Safety

February 15 — February 29, 2000

Summary 2000-04

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Operating Experience Summary 2000-04
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EVENTS

1. CRACKS FOUND ON NEWLY-INSTALLED EXHAUST DUCTING

On February 8, 2000, at Hanford, replacement B Plant Canyon exhaust system ducting was found to have cracks, and the system was shut down within a few hours of the discovery. The condition was reported to the State of Washington Department of Health. A radiological survey did not detect any contamination outside the ducting. Cracked or deteriorated exhaust ducting can spread contamination and endanger workers and the public and bypass emission monitoring. (ORPS Report RL--PHMC-BPLANT-2000-001)

Investigators determined that this ventilation system had recently been installed because of cracks in the previous system. (ORPS Report RL--PHMC-BPLANT-1999-0003) The replacement ducting was placed in service on February 7, 2000 and on the following day two new cracks were discovered and the system was shut down. Figures 1-1, 2 and 3 show the configuration and the location of the cracks.

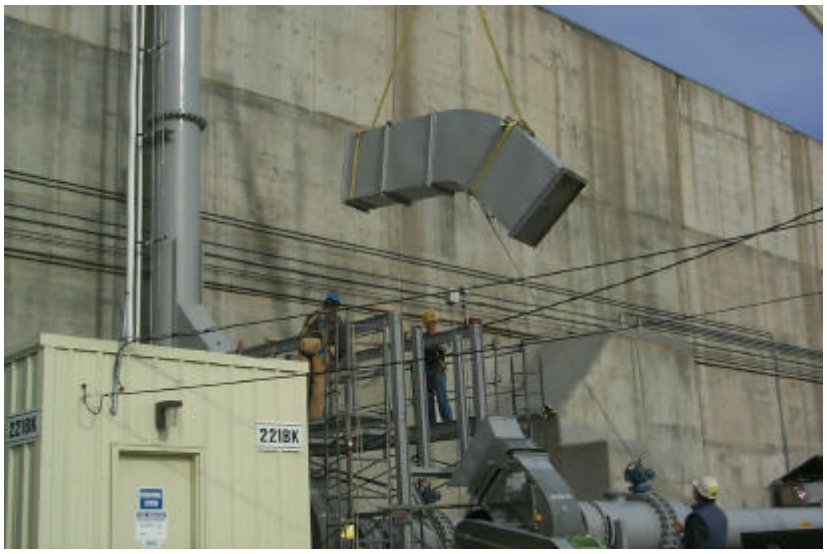

Figure 1-1. Placement of Duct

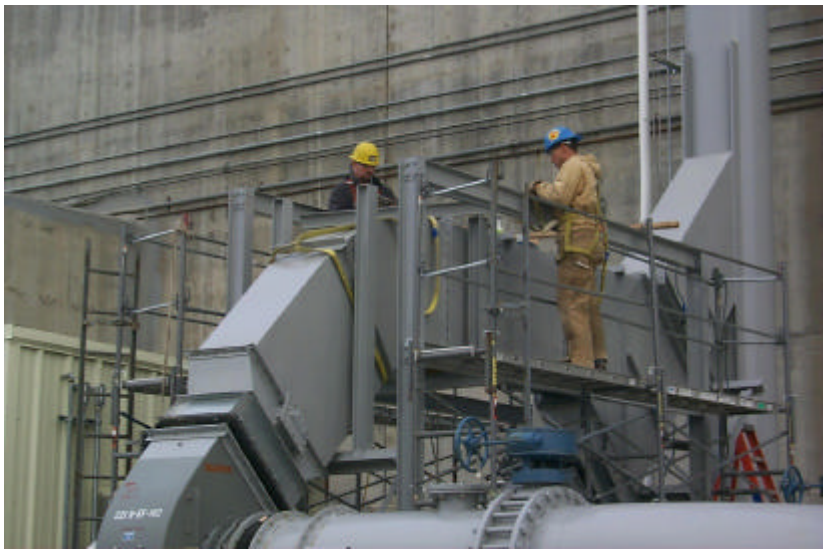

Figure 1-2. Duct in Place

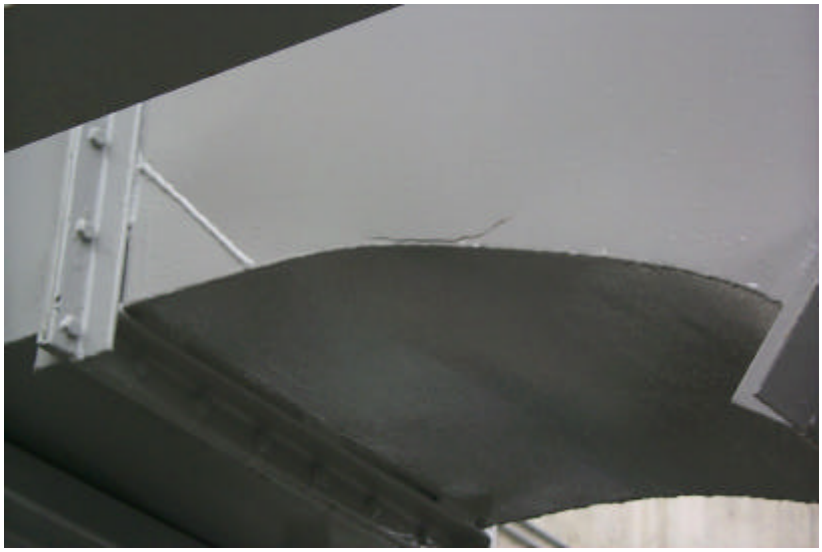

Figure 1-3. Crack Location

The exact nature of the 1999 failures was not reported in the final ORPS report of November 1999. The contractor installed the replacement system at no cost to DOE and believed that the changes would solve the problem. Investigators determined that the original ductwork was not designed, fabricated and installed to the *Sheet Metal and Air Conditioning Contractors National Association Construction Standard* as the original specifications required. The first occurrence was attributed to a failure to follow design code requirements.

The investigation determined that the system was designed for a range of flows from approximately 7,500 to 18,000 CFM, and the system had operated for about a year at the higher (normal) flow rate with no problems. The system flow rates changed in late summer 1999 to the lower design rate when one of the two filter trains was removed from service to replace the filters. The replacement system was started in February 2000, also at this lower flow rate. The investigators hypothesized that, since both failures occurred at the lower flow rate, this condition may be inducing stresses and causing the cracks. The investigators will review this and any other potentials before the system is repaired and restarted. EH will monitor the progress and report any significant findings in an update article.

KEYWORDS: duct cracks, design change, specifications, replacement

FUNCTIONAL AREAS: Design, Engineering, Operations

2. MOBILE CRANES OPERATED WITHOUT MONTHLY PREVENTIVE MAINTENANCE

On February 3, 2000, at Idaho National Engineering and Environmental Laboratory, a Hoisting and Rigging Coordinator noted that the mobile cranes in use at the Nuclear Technology and Engineering Center had not undergone monthly preventive maintenance (PM). This violates the requirements of the Hoisting and Rigging Manual. Line management immediately tagged out of service all the mobile cranes needing monthly PM. Though no one was injured, the use of hoisting and rigging equipment without regular monthly PM poses potential safety hazards. (ORPS Report ID--BBWI-LANDLORD-2000-0005)

All the mobile equipment is located at the Central Facilities Area (CFA) vehicle pool. The CFA management, which rents equipment to other facilities, stopped performing regular monthly PMs on the cranes and mobile equipment a few years ago. Investigators determined that CFA did not have a regular monthly PM system of its own, and it did not communicate any specific guidelines to the renters regarding their monthly PM responsibility. This lack of communication and procedural lapse resulted in a high potential for safety risks.

Investigators also determined that there is no well-defined protocol identifying monthly PM responsibilities of CFA or the renter facilities, indicating a lack of proper administrative control.

Investigators also also noted that on February 9, 2000, at INEEL a rigging crew offloading an Abrams M1 tank from a transport trailer heard a loud pop and immediately lowered the load back on the trailer. A preliminary investigation revealed that the protective sleeve and the protective sheath around the kevlar strands on one of the lifting slings had ruptured and torn, while the individual strands inside the slings appeared undamaged. The facility management stopped lifting activities and the overhead crane was tagged out-of-service.
(ORPS Report ID--BBWI-SMC-2000-0002)

EH has reported a number of similar events in OE Summaries. The following are a few examples.

- Operating Experience Summary 99-26 reported that on June 9, 1999, at the Pacific Northwest National Laboratory (PNNL), a preventive maintenance specialist discovered that the PNNL preventive maintenance group had failed to reinstate the monthly wire rope inspection required to restore a 2-ton beam crane to operability following a prolonged deactivation. On June 16, 1999, while performing the reinstated inspection, a millwright discovered that the wire rope on the crane did not match the load block sheave size and that the latch on the load hook was bent and would not function properly. Sheave grooves should match the rope size as closely as possible in order to maximize the service life of the rope and prevent the rope cross-section from deforming under load. (ORPS Report RL--PNNL-PNNLBOPER-1999-0021)
- Operating Experience Summary 98-22 reported that on May 15, 1998, at the Oak Ridge National Laboratory Y-12 Nuclear Operations Facility, a boom fell, struck a maintenance worker, and pinned one of his fingers to a railroad tanker car when a hoisting cable broke. Facility medical staff treated the worker for a bruised finger and released him. Maintenance workers were transferring sulfuric acid from the tanker car to a facility tank. They used the boom to raise and lower piping and a flange to the top of the tanker car. Investigators determined that the cable, which was not weatherproof, had been exposed to weather elements over a 10-year period, and no one inspected it before the operation began. Facility managers placed the boom out-of-service and directed personnel to stop using it till completion of the on-going investigation.
(ORPS Report ORO--LMES-Y12NUCLEAR-1998-0044)

These incidents illustrate the importance of inspecting mobile equipment that carries suspended loads to ensure safe handling. In this type of operation, personnel injuries, fatalities, or equipment damage can result from falling loads due to failure of crane booms, lifting devices and slings. Regular preventive maintenance of hoisting and rigging equipment considerably reduces the potential of such events. Facility managers and personnel who are charged with safe operation of suspended load equipment and hoisting and rigging equipment can find inspection guidelines in the following references.

- DOE-STD-1090-99, Revision 1, *Hoisting and Rigging*, provides guidance for hoisting and rigging and identifies related codes, standards, and regulations. The web address for this standard is http://tis.eh.doe.gov/techstds/standard/appframe.html.
- 29 CFR 1926 specifies regulations regarding construction safety. OSHA construction safety information can be downloaded from the OSHA construction home page at http://www.osha-slc.gov/html/construction.html.

KEYWORDS: preventive maintenance, crane, administrative control, procedure violation

FUNCTIONAL AREAS: Industrial Safety, Communication

3. ALIGNMENT OF MULTIMATIC DELUGE SYSTEM VALVES

On February 4, 2000, at Pantex, Fire Protection Engineering and Systems Engineering staff discovered open air line bleed valves on deluge systems designed and constructed as pre-primed deluge systems. The systems were never primed, and have been maintained and operated as standard dry-pipe deluge systems equipped with automatic Multimatic deluge system valves. The open air line bleed valves perform no function in a dry state of operation. This condition presented an unreviewed safety question (USQ) as to the operability of the system for fire safety.
(ORPS Report ALO-AO-MHC-PANTEX-2000-0010)

Investigators found different configurations of air line bleed valve positions during a walkdown of the facilities. The original function of the bleed valves was to ensure fast removal of air from the piping system, when being filled

with water. Bleed valves perform no function, when the deluge systems are operated in a dry mode. The plant personnel took the following immediate corrective actions.

- Transferred the facility in operation to maintenance mode
- Placed Fire Department precautionary fire watch over the affected facilities
- Closed and sealed (wired shut) all bleed valves

The site's fire protection engineers reviewed the design of the deluge system to assess the USQ concerns. Each deluge system at the facility was originally designed to provide enough flow so that all the open heads would provide the calculated water flow upon system activation. The results of the calculations establish minimum flows and pressures for each facility to achieve the design density for fire safety. Calculations for each fire protection system must fall under the High Pressure Fire Loop (HPFL) supply curve. If the flow and pressure parameters of the deluge system in any configuration exceed the HPFL supply curve, the system no longer achieves its design density and will not meet fire protection demands of the facility.

An additional pathway for water discharge is created when one or more of the bleed valves are in open position. This water discharge imposes an unknown increase to the design flow and pressure calculations for the system. The plant's Fire Protection Engineering review of all hydraulic calculations has demonstrated that the increased system demand with any configuration of open air bleed valves does not exceed the HPFL supply curve. All the deluge systems are reliably operable for effective fire protection regardless of any position of the bleed valves. These configurations assure reliability of the fire protection system to satisfy the Criticality Safety System requirements at the plant. The investigators determined the following conclusions.

- The air line bleed valve alignment did not adversely impact the fire protection systems' reliability
- A surveillance program will be provided to ensure all bleed valves remain closed

KEYWORDS: multimatic deluge system, reliability, USQ

FUNCTIONAL AREAS: Fire Safety, Fire Protection

4. REQUIRED AIR MONITOR MISTAKENLY SHUT DOWN FOR EXTENDED PERIOD

On February 2, 2000, at the Hanford Site, surveillance and maintenance workers discovered that the subcontractor shut down a required air sampling monitor from May 24 until September 30, 1999. The monitor was shared by two distinct projects and was required by a Department of Energy Sampling and Analysis Plan for the disposition of standing legacy wastes. The subcontractor did not recognize the violation when they followed one project's closeout instructions and shut down the shared monitor. Facility management notified Department of Energy and Environmental Protection Agency authorities. There were no known injuries to personnel or damage to the environment from the lack of a shared monitor. Serious personnel injuries or environmental damage can occur when multiple function equipment is removed from service without forethought. (ORPS Report RL--BHI-IFSM-2000-0001)

KEYWORDS: air monitor, shared equipment

FUNCTIONAL AREAS: Work Planning

5. REACTOR OPERATED WITH FAULTY CONTROL ROD

On February 17, 2000, at the Los Alamos National Laboratory, facility management suspended operations on a 50-year old spherical core class B reactor known as "Flattop" after operators failed to shut it down when a control rod became stuck. The reactor safety committee decided to maintain shutdown status until the control rod could be repaired in accordance with Department of Energy requirements. There were no injuries associated with this event. Operating a nuclear reactor without regard to operating procedures can lead to personnel injury, equipment damage, and environmental releases. (ORPS Report ALO-LA-LANL-TA18-2000-0001)

The Flattop critical assembly uses moveable elements to control reactivity. These elements consist of five blocks or rods that surround the assembly's fissionable material. Investigators determined that a vernier reactivity control rod had been sticking intermittently but with increasing frequency since 1992. They determined that continued operations with the faulty control rod constituted a technical safety requirement violation; an occurrence that prompted both the reactor operations team leader and facility management to suspend further Flattop operations pending Department of Energy approval. Investigators also determined that the reactor's operating procedures require plant shutdown for a stuck control rod.

EH engineers identified the following similar event in which there was a lack of formality when following procedure.

- Operating Experience Summary 98-33 reported that on August 11, 1998, at the Los Alamos Pajarito Laboratory, an instructor preparing a demonstration experiment for a criticality safety training course added a mass of special nuclear material to other materials on a cart and exceeded the allowable mass limit for a single storage area. A group leader immediately notified the facility manager of the event. In response to the incident, the division director ordered a stand-down of manual handling of special nuclear materials at the site. Investigators determined that the instructors performed the demonstration experiments in accordance with procedures. Analysis and calculations indicated that there was no significant reduction in the margin of criticality safety. (ORPS Report ALO--LA-LANL-TA18-1998-0008)

KEYWORDS: technical safety violations, control rod, improper procedure

FUNCTIONAL AREAS: Conduct of Operations, Procedures, Training and Qualification

6. FIFTY-YEAR OLD FIRE ALARM SYSTEM FAILS TEST

On February 19, 2000, at the East Tennessee Technological Park, a fire alarm transmitter failed to send a coded alarm to the fire alarm center while firefighters performed a semi-annual test on a fire sprinkler system. The East Tennessee Technology Park fire department initiated a fire-watch, notified facility management, and scheduled a system repair. There were no injuries associated with this event. Unreliable fire alarm systems may fail and lead to personnel injury. (ORPS Report ORO--BJC-K25GENLAN-2000-0003)

Investigators determined that the fire alarm transmitter is part of a coded telegraph system that relies on a clockwork mechanism to operate, and that it is a safety-significant component. They determined that when the 50-year-old system sends five clear rounds of a four-digit code to the alarm center, this indicates a fully functional system. A problem is presumed to exist when fewer than five clear rounds are transmitted. Maintenance must then be performed. One clear round out of five must be received for the system to be considered a functioning safety system. Investigators learned that facility management has made proposals to replace the coded telegraph system.

A similar event occurred at the East Tennessee Technology Park on February 25, 2000 when a fire alarm failed to send the required five rounds of a four-digit code to the alarm center when a fireman tested it. This second event confirms a potential reliability problem with antiquated alarm systems. (ORPS Report ORO--BJC-K25GENLAN-2000-0004)

EH engineers identified the following similar events where fire alarms and systems failed to function properly.

- Operating Experience Summary 98-02 reported that on January 7, 1998, fire protection personnel discovered a de-energized fire panel. The circuit breaker for normal AC power to the panel was open and the backup batteries were depleted. On January 8, an operations mentor discovered that a test procedure for a fire panel could have compromised the ability of facility personnel to respond to a fire during panel testing. On January 9, removal of a compensatory fire watch before completion of surveillances on this same fire panel resulted in a violation of the facility Operational Safety Requirements (OSRs).
(ORPS Reports ALO-LA-LANL-PHYSCOMPLX-1998-0001, ALO-LA-LANL-CMR-1998-0001, ALO-LA-LANL-CMR-1998-0002)
- Operating Experience Summary 98-48 reported that on November 25, 1998, at the Idaho National Engineering and Environmental Laboratory Radioactive Waste Management Complex, a facility manager reported that for approximately three weeks the fire station had been unable to receive fire alarm notifications from several facilities because the fire alarm panels were not functioning as intended. Life safety system

technicians discovered the impaired alarm notification system while performing routine monthly heat detector testing. They determined that on November 2, maintenance technicians had replaced a data terminal unit for fire alarm panels with one that contained an incompatible data protocol program. Therefore, the fire alarm panels were unable to recognize any fire alarm signals received from several facilities in the Complex. Telecommunications personnel reprogrammed the data terminal unit with the appropriate protocol and verified that the alarm reporting capability was restored. (ORPS Report ID--LITC-RWMC-1998-0007)

- Operating Experience Summary 99-07 reported that on February 1, 1999, at the Rocky Flats Environmental Technology Site Analytical Operations, fire department personnel discovered that 10 facility fire alarm system delta points for fire phones, filter plenum overheat detectors, smoke detectors, and flow alarms were not reporting to the new Unity sitewide fire protection system. A shift manager directed integrated systems services to troubleshoot the failures. Integrated systems services personnel determined that the data on a local server were corrupted. The local server provides facility delta point monitoring to the Unity system. Investigators have not determined how the server data became corrupted. However, maintenance personnel had successfully performed post-installation testing before placing the system into operation. Investigators also determined that although compensatory measures were required when this error was discovered, they were not properly implemented in some facilities. Safeguard controls may not exist to prevent corruption of the Unity system or other microprocessor computer systems throughout the DOE complex. Corruption of these systems can occur from a wide variety of sources and could result in failure modes that may not be preventable. (ORPS Report RFO--KHLL-ANALYTOPS-1999-0003)

These events underscore the importance of ensuring that fire protection systems are maintained in operational readiness. Facility managers should ensure that work controls are rigorous enough to prevent unplanned system impairments and to maintain facility and personnel safety during planned impairments.

- DOE O 420.1, *Facility Safety*, requires fire protection systems for DOE facilities to include means for notifying and evacuating building occupants and means for summoning a fire department.
- DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter VIII, "Control of Equipment and System Status."
- DOE O 5480.22, *Technical Safety Requirements*, defines the terms "operable" and "operability" and provides six implementing principles.
- DOE/EH-0513, Safety Notice 95-04, *Post-Maintenance Test Programs*, December 1995, provides guidance and good practices for establishing effective post-maintenance test programs. http://tis.eh.doe.gov/web/oeaf/lessons_learned/ons/sn9504.html

KEYWORDS: configuration control, fire protection, testing

FUNCTIONAL AREAS: Configuration Control, Fire Protection